Reaction Rate

- Change in concentration per unit time

Haber Process

- $N_2 + 3H_2 \longrightarrow 2NH_3$

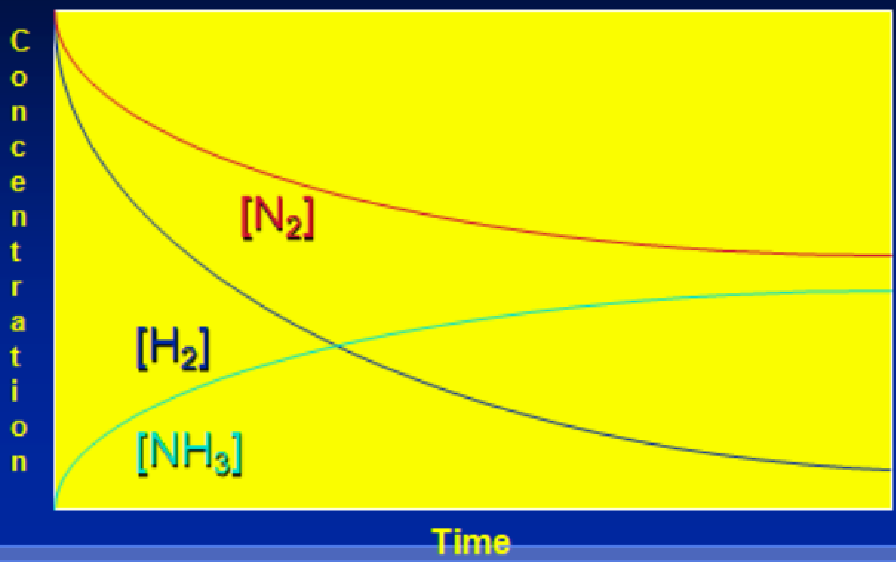
$Rate = k[N_2]^1[H_2]^3$

k

$\frac{mol/L}{s}$

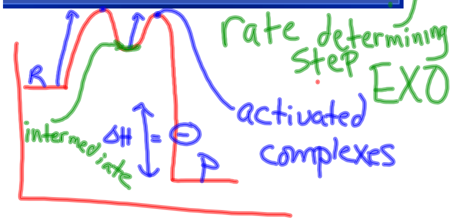
$\frac{mol/L}{time}$

- As the reaction progresses the concentration NH_3 goes up.



Reaction Mechanisms

- $2NO_2 + F_2 \longrightarrow 2NO_2F$ + energy — net reaction
- The proposed mechanism is
- $NO_2 + F_2 \longrightarrow NO_2F + F$ (slow)
- $F + NO_2 \longrightarrow NO_2F$ (fast)
- F is called an <u>intermediate</u> It is formed then consumed in the reaction



A ⟶ products	Rate = k[A]
A+A ⟶ products	Rate= $k[A]^2$
2A ⟶ products	Rate= $k[A]^2$
A+B ⟶ products	Rate= k[A][B]
A+A+B ⟶ Products	Rate= $k[A]^2[B]$
2A+B ⟶ Products	Rate= $k[A]^2[B]$
A+B+C ⟶ Products	Rate= k[A][B][C]

Formed in reversible reactions

- $2\ NO + O_2 \longrightarrow 2\ NO_2$
- Mechanism
- $2\ NO \rightleftharpoons N_2O_2$ (fast)
- $N_2O_2 + O_2 \longrightarrow 2\ NO_2$ (slow)

Formed in fast reactions

- $2\ IBr \longrightarrow I_2 + Br_2$
- Mechanism
- $IBr \longrightarrow I + Br$ (fast)
- $IBr + Br \longrightarrow I + Br_2$ (slow)
- $I + I \longrightarrow I_2$ (fast)